COURSECONTENT

STRUCTURAL OPTIMIZATION								
I Semester: SE								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
2512046	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
contactClasses:45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**TotalClasses:45**		
Prerequisites: NIL.								

Course Overview:

This course introduces optimization techniques applied to structural engineering problems. It covers concepts such as simultaneous failure modes, classical external problems, and variational principles with constraints. Students learn various optimization methods including linear, integer, nonlinear, dynamic, geometric, and stochastic programming. The course emphasizes practical applications in the design of steel and concrete members, trusses, and frames. It also addresses layout design and frequency constraints, enabling students to develop efficient, safe, and economical structural solutions using modern optimization approaches.

Course Objectives:

1. To understand simultaneous failure modes and classical external optimization problems.
2. To learn variational principles and their application to constrained optimization.
3. To gain knowledge of linear, integer, nonlinear, and dynamic programming methods.
4. To understand geometric and stochastic programming for engineering optimization.
5. To apply optimization techniques to steel and concrete structures, trusses, frames, and layout design.

Course Outcomes: After Completion of the Course, Students should be able to

1. Explain the concepts of simultaneous failure modes and classical external problems in structural design.
2. Formulate variational principles and constraints for solving optimization problems.
3. Apply linear, nonlinear, integer, and dynamic programming techniques to engineering optimization problems.
4. Analyze optimization problems using geometric and stochastic programming.
5. Design structural components and layouts considering frequency constraints and material behavior.

SYLLABUS:

UNIT – I
Introduction: Simultaneous Failure Mode and Design, Classical External Problems.

UNIT – II
Calculus of Variation: Variational Principles with Constraints.

UNIT – III
Linear Programming, Integer Programming, Nonlinear Programming, Dynamic Programming.

UNIT – IV
Geometric Programming and Stochastic Programming.

UNIT – V
Applications: Structural Steel and Concrete Members, Trusses and Frames.
Design: Frequency Constraint, Design of Layouts.

REFERENCE BOOKS:

1. Elements of Structural Optimization, Haftka, Raphael T., Gürdal, Zafer, Springer.
2. Variational Methods for Structural Optimization, Cherkaev, Andrej, Springer.

MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Definitions and terminology
4. Assignments
5. Model question paper–I
6. Model question paper–II
7. Lecture notes
8. E-Learning Readiness Videos(ELRV)